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CORPORATE SOCIAL RESPONSIBILITY AND INVENTORY POLICY*

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CORPORATE SOCIAL RESPONSIBILITY AND INVENTORY POLICY

Abstract

In this article, we study the impact of implementing corporate social responsible (CSR) practices on a firm's inventory policy. Our proposal is that there is an inverted U-shape relationship between firms' CSR and their inventory levels. Two elements explain such proposal. First, stakeholders have different interests regarding the outcome of the inventory system. Specifically, we hypothesize that customers pressure firms to increase inventories; employees have conflicting views regarding inventories and, for this reason, they do not pressure firms in a particular direction; and environmental activists force firms to reduce inventories. The second reason is that there is different level of stakeholder proactiveness contingent on the intensity in the implementation of social responsible policies. In particular, we posit that for low levels of CSR, customers are more relevant, while for larger levels other stakeholders gain more importance.

We test this theoretical prediction by crossing two databases, COMPUSTAT, for financial data, and KLD for data on social responsibility. Our final database contains data on 1881 different US companies for the period 1996-2006. The results found conform to our theoretical prediction.

Our analysis will be helpful to strategic and tactical decision-making processes on inventory management and will allow researchers to offer concrete advice on the likely outcomes of various stakeholder relationship practices in order to improve the effectiveness of inventory systems. Additionally, the connection between CSR and inventory policies has interest at a macroeconomic level given that, on the one hand, there is a growing tendency for firms to behave in a socially responsible way. On the other, inventories are responsible for up to 87% of the total peak-to-trough movement in GDP. Thus, our results suggest that this tendency to incorporate the social dimension in firms' strategy should smooth out the overall economic cycle given that firms apply more intensive CSR policies in the expansive periods (decreasing inventories) rather than during the downturns (increasing inventories).

Keywords: corporate social responsibility; stakeholders; inventories.

1. INTRODUCTION

Inventories constitute a type of corporate investment that can play different roles within the firm. Traditionally, inventory management has been associated with volume and timing decisions (Blinder and Maccini, 1991). Researchers and managers have been focused on elucidating the size of orders, when replenishment orders should take place, and what systems firms should implement to manage the above decisions.

More recently, theory and practice have reached a consensus that inventory management is more than managing operative day-to-day decisions. Inventories also encompass an organizational dimension. Information flows and communication systems within the organization, decision-making processes, and the participation in the implementation of inventory management systems of different actors with different perceptions, interests and influence capacity, may affect the day-to-day performance of an inventory system (de Vries, 2005). Not only may daily operations be influenced by the organizational context, but also more strategic decisions like the redesign of the inventory system (de Vries, 2009). Some studies indicate, for example, that an inventory project may be the result of a political process where different organizational actors have different perceptions regarding the acceptation, adaptation, and implementation of the system (de Vries, 2009). For this reason, inventory systems are not always the result of a pre-determined approach, but the outcome of a process heavily influenced by the interests of different stakeholders.

Although different definitions of stakeholders have been suggested in the literature, one of the most widely accepted definitions is provided by Freeman (1984: 46), who considers a stakeholder as any group or individual who can affect or is affected by the achievement of corporate objectives. Typically, the groups that fulfil this definition are resource suppliers (including shareholders), employees, community residents, customers, and the natural environment.

The organization cannot survive without stakeholders' active participation (Clarkson, 1995), which has led stakeholders to develop abilities to influence corporate decisions (Mitchell et al., 1997). This influence capacity has been reflected in the development of a broad array of strategies and operating practices within the firm in order to deal with and create close relationships among different stakeholders; the so-called corporate social responsibility (CSR) activities (Waddock, 2004).

Our study draws upon existing research on the influence of CSR on corporate decisions to analyze a particular one, which is a firm's inventory accumulation decision. Only a limited number of studies have empirically analyzed how stakeholders shape inventory management (Janssen, 2005), and practically all of them are based on case study methodology (e.g., de Vries, 2009). There are no studies providing systematic evidence as to the effects of CSR on inventories. In this paper, we advance in this direction and study whether improvements in the satisfaction of employees, customers, and natural environment interests increase, reduce or do not affect inventory volume.

Addressing this question will be helpful to strategic and tactical decision-making processes on inventory management and will allow researchers to offer concrete advice on the likely outcomes of various stakeholder relationship practices. Additionally, a clear understanding of the relationship between CSR and inventories may also be beneficial for improving the effectiveness of inventory systems.

The main conclusion of this study is that CSR and inventory-to-sales ratio are not linearly related, but there is a curvilinear relationship. Specifically, we find an increase in firms'

inventory-to-sales ratio for low levels of social responsibility while, for high levels of proactivity towards stakeholders, the inventory-to-sales ratio decreases. Two elements explain this relationship. First, stakeholders have different interests regarding the outcome of the inventory system and, for this reason, some stakeholders, like customers, pressure firms to increase inventories, others do not pressure in a particular direction (employees), and a third type of stakeholder, like the environment, force firms to reduce inventories. The second reason to justify an inverted U-shape relationship between CSR and firms' inventories is that there is different level of stakeholder proactiveness contingent on the intensity in the implementation of social responsible policies and, at each level, stakeholders differ in their capacity to influence corporate decisions. This means that firms strategically manage CSR to focus on specific stakeholder groups that control critical resources for the firm's success. In particular, we posit that for low levels of CSR, customers are more relevant, while for larger levels other stakeholders gain more importance.

We test these theoretical predictions by crossing two databases, COMPUSTAT, for financial data, and KLD for data on social responsibility. Our final database contains data on 1881 different US companies for the period 1996-2006. The results found conform to our theoretical predictions.

The remainder of the paper is organized as follows. Section 2 develops the theoretical underpinnings and presents the hypotheses to be tested. In Section 3, we carry out the empirical analysis. The paper concludes with some final remarks.

2. THEORETICAL BACKGROUND AND HYPOTHESES

Key Stakeholders and Inventories

In a recent study, De Vries (2009) has shown that stakeholders influence the design and redesign and the implementation of inventory systems, because different stakeholders have different interests regarding the outcome of such systems, and sometimes they have the power to shape a firm's decision-making processes to select inventory projects that benefit themselves. Building on this work, in this section we develop arguments linking three different types of stakeholders – customers, employees, and the natural environment – and the outcomes of an inventory system: the inventory level of the firm.

Customers/product safety. One of the functions of inventories is the immediate provision of products, while minimizing the occurrence of stock-outs, which may generate organizational problems. Inventories are buffers (they protect against uncertainties) for meeting customer requirements. Stock availability has a direct effect on total order cycle time (i.e., elapsed time between customer order and the moment when the product or service is received by the customer) and may force firms to move products out of the established distribution channel with its corresponding costs. The availability of inventories to customers avoids these costs and allows the maintenance of sales and even their increase (Ballou, 2004). High product/service quality, shorter and more reliable lead times and fewer shortages are typical factors that contribute to higher levels of customer satisfaction. Firms can respond to these requirements using protective inventories. Thus, increasing inventory levels in the supply chain normally results in better customer service, measured in terms of ability to satisfy customer demand within a certain time, although at a cost in terms of logistics (Ballou, 2004; Neale et al. 2006).

Besides, customer satisfaction could also be achieved through a broader offer of products. Normally, a wider assortment of products results in higher levels of inventories

(Cachon and Olivares, 2010; Fisher et al., 1995). Therefore, when companies try to meet a customer's expectations it is likely that they increase their inventory levels.[2] Thus, we propose:

Hypothesis 1a. A firm's social responsible behavior towards customers will have a positive impact on inventory investment.

Employees. Investing in socially responsible activities such as the provision of a clean and safe working environment, training opportunities, long-term contracts, health and education benefits, and profit-sharing payment schemes can have a positive impact on employees' motivation and morale, reducing absenteeism and staff turnover (Branco and Rodrigues, 2006) and stimulating the acquisition of firm-specific human capital by attracting and retaining highly skilled workers (Greening and Turban, 2000; Turban and Greening, 1997).

Such progressive human resource policies have been shown to relate positively to inventory performance (Schonberger, 2007). Lieberman and colleagues (1999) showed that inventories were lower for plants in which the workforce engages in working process improvements. Indeed, the need for protective buffer inventories could be decreased with worker commitment, motivation and improvements in skills. Working with low inventory levels while satisfying customer delivery requirements is not likely to occur without quality and continuous improvement orientation, which requires all employees to be actively engaged in improving the production process, monitoring quality, identifying the root causes of the quality problems and solving them. In order to achieve such employee engagement, firms should create the appropriate organizational culture, develop incentive systems that reward good operational performance and effort, invest in fostering employee skills, facilitate teamwork, and empower employees (Reid and Sanders, 2005).

However, some human resource practices may have the opposite effect on inventories. Generous salaries and long-term contracts are dimensions of a firm's social responsibility that managers may promote in order to obtain employees' support that sometimes have a negative effect on labor productivity and, hence, financial performance (Pagano and Volpin, 2005). In such cases, labor contracting based on worker turnover cannot be used as a substitute buffer mechanism to inventories (Haltiwanger and Maccini, 1988, 1990 and 1994). Hence, firms are expected to accumulate more inventories in this situation to prevent demand shocks.

Therefore, there are two countervailing effects of employee satisfaction on the level of inventory: on the one hand, policies such as training, empowerment, and rewards are expected to reduce the inventory and, on the other hand, long-term contracting is expected to increase it. Hence, a neutral final effect of the employee relations to the inventory level is expected.

Hypothesis 1b. A firm's social responsible behavior towards employees will have a neutral impact on inventory investment.

Natural environment. Russo and Fouts (1997) distinguished two types of environmental policies: compliance and pollution prevention. Firms following a compliance policy rely on pollution abatement through a short-term "end-of-pipe" approach, often resisting the enactment and enforcement of environmental legislation. The second environmental policy consists of going beyond compliance to focus on prevention, with a systematic approach that emphasizes source reduction and process innovation. Compliance and prevention polices are supported by different resource bases. Compliance is achieved primarily by using technologies

[2] Some researchers have pointed out that production systems such as lean manufacturing may work with low inventory levels while satisfying customer requirements (Lieberman and Demeester, 1999). However, these systems take place in companies that also attach high importance to other stakeholders such as workers and the environment.

that treat harmful by-products at the end of the process. Thus, these technologies treat waste once produced and, therefore, they do not fundamentally vary the production or service delivery process. Contrarily, a proactive environmental policy is expected to lead firms to redesign their production or service delivery process. The result of a proactive improvement in pollution prevention is a reduction in waste and pollution during the manufacturing process (Hart, 1995).

Environmental performance is intrinsically related to low inventory levels. The objective of reducing waste and pollution generated from components and parts may be achieved by working with lower inventory levels. For example, efforts to reduce energy requirements (electricity, gas, and oil) and water consumption, which ultimately have an impact on air emissions and water pollution, have led firm to decrease storage facilities (Sarkis et al., 2004) and with that, inventory levels. In addition, CSR's goal of eliminating pollutant, obsolete materials can be fulfilled by means of reduced inventories, since they decrease obsolescence and spoilage rates (Sarkis et al., 2004). Therefore, higher levels of environmental efficiency – the reduction of environmental impact through more efficient use of natural resources and materials – will generate lower inventory levels (Rothenberg *et al*, 2001). This is our third hypothesis:

> *Hypothesis 1c. A firm's social responsible behavior towards the natural environment will have a negative impact on inventory investment.*

Corporate Social Responsibility and Inventories

The purpose of this section is to connect firm's overall social responsibility performance to its inventory policy once we take into consideration the previous theoretical statements.

Existing research suggests that stakeholder pressure is one of the most important drivers of CSR (Agle et al., 1999; Bansal and Roth, 2000; Mitchell et al., 1997; Kassinis and Vafeas, 2006). Stakeholders' ability to influence corporate decisions stems from their contributions to their survival and profitability (Clarkson, 1995); the power, legitimacy, and urgency of their claims (Mitchell et al., 1997); their control of critical resources (Pfeffer and Salancik, 1978); and their ability to pressure other groups on whom the firm depends (Frooman, 1999). Diverse stakeholders, such as employees (Turban and Greening, 1997), customers (Christmann, 2004), suppliers (Waddock et al., 2002) and environmental groups (Sharma and Henriques, 2005) increasingly pressure corporations to behave responsibly. However, stakeholders differ in their ability to pressure firms (Mitchell et al., 1997) and firms also differ in their perceptions of the relative importance of different stakeholders in influencing their CSR practices (Henriques and Sadorsky, 1999). As a consequence, firms differ in how they deal with different stakeholders. The primary source of those variations is the extent to which the firm is resource-dependent on those stakeholders. Hence, firms are not likely to address issues and concerns of all stakeholders all the time (Jawahar and McLaughlin, 2001). Instead, they will pay more attention to those issues of stakeholder groups who control resources that are critical for the firm's success. For example, at the start-up stage of the firm's life cycle, customers are, in addition to suppliers of finance, the most critical stakeholder group for firm survival since it is necessary to gain their acceptance for products. At the mature stage, the availability of slack resources provides opportunities for firms to deal with most stakeholders – especially, employees, environmental groups, and suppliers – in a positive manner.

Also, mature firms may face different levels of pressure by stakeholders to embrace CSR. In turn, these pressures shape firms' social and environmental strategy. Previous research has described four possible strategies towards CSR: reactive, defensive, accommodative and proactive (Clarkson, 1995). A reactive strategy involves either fighting against or ignoring stakeholders' demands, and denies responsibility for managing these issues. A defensive

strategy involves doing the least what is legally required to address stakeholders' issues. Thus, the firm's posture is to admit responsibility for managing stakeholders' issues, but fight it. The accommodative strategy involves doing all that is required with a more active approach than the defensive strategy, accepting responsibility for managing stakeholders' issues. Finally, the proactive strategy involves doing a great deal to address a stakeholders' issues, even anticipating in addressing specific concerns or leading an industry effort to do so (Clarkson, 1995; Jawahar and McLaughlin, 2001).

Customer preferences and monitoring are the main reasons for a firm moving beyond a reactive position to more socially responsible strategies. As public concerns about social and environmental issues grow, customers increasingly consider social factors when taking their purchase decisions, thereby affecting corporate performance (Christmann, 2004). Several studies have empirically shown that customer pressures are one of the most important drivers of a firm's social conduct. For example, Christmann and Taylor (2006) studied the factors that influence the firm's level of social responsibility and concluded that firms strategically choose their level of compliance with social and environmental standards depending on customer pressure. Similar conclusions are reached by Henriques and Sadorsky (1999), among others.

Remarkably, as firms become more socially responsible, they consider broader interests. Specifically, firms that follow a proactive strategy do not respond selectively to different stakeholders, but they take into account the interests of all groups similarly and simultaneously (Murillo-Luna et al., 2008). Thus, firms with low levels of CSR focus their attention almost exclusively on their customers, while socially responsible firms consider the interests of all stakeholders.

Considering the effects of customers, employees and the natural environment on inventories described in previous Hypotheses 1a-1c, we expect low levels of CSR to have a positive impact on the level of inventories, while high social responsibility will reduce that level. Accordingly, we propose:

> *Hypothesis 2. A firm's social responsible behavior have a curvilinear (inverted U-shape) relationship to inventory investment.*

3. EMPIRICAL ANALYSIS

3.1 Description of Data and Variables

We carried out our empirical analysis making use of an annual sample of U.S. firms extracted from the COMPUSTAT database for the period 1996-2006. We merge this database with the KLD database that provides information on CSR based on a series of items that capture strengths and concerns on social issues for five different stakeholders, namely: customers, employees, environment, community and corporate governance. From this sample, we selected only those companies that were active for at least 5 years during the period 1996-2006 and excluded companies that have been involved in mergers and acquisitions. Additionally, we removed outliers by excluding the top and bottom 1% of companies in terms of the inventory-to-sales ratio. Our final database contains data on 1881 different US companies with 9269 observations for the period 1996-2006. Because available inflation indexes are too aggregate and cannot control for different price indexes in input and output data at the firm level[3], we do not use constant US dollars, and control for inflation by using variables expressed in the same price term and relative values.

[3] Accounting and finance literature recommend not to use constant price since managers usually make their decisions based on current price level data. See, for example, Kothari (2001).

We conduct our cross-company analysis using a relative inventory measure, which is captured by the ratio of inventory to cost of goods sold (*Relat_Inv*). This is our dependent variable. According to our theoretical setting, the main explanatory variable of our interest is a firm's CSR. Additionally, and based on previous literature (Rumyantsev and Netessine, 2007; Gaur, Fisher and Raman, 2005, and Lieberman *et al.* 1999), we also include the following control variables: firm size, sales margins, lead time, sales growth, financial structure and sales uncertainty.

The proxies used for the previous explanatory variables are the following: corporate social responsibility (*CSR*) is measured using the rating provided by the KLD database, which is the sum of the values that correspond to the CSR of five different stakeholders (customers, employees, environment, community and corporate governance). For approaching the CSR of each stakeholder, we take the difference between a firm's strengths and concerns in relation to each stakeholder, which are proxied by a set of different items (Waddock and Graves, 1997) [4]. In this way we have defined *Customer CSR*, *Employee CSR* and *Environment CSR*[5] needed in order to test Hypotheses 1a, 1b and 1c.[6] For control variables, company size (*Size)* is approached by means of total assets. This variable will measure possible scale economies in inventory storage as well as the effect of diversification given that large firms tend to be more diversified. Gross margin (*Gross Margin*) is the ratio of the difference between sales and the cost of goods sold to the sales amount. This variable captures inventory underage cost, that is, the cost of having a low inventory level (Silver et al 1998). The larger the gross margin, the larger the underage cost. We consider gross margin better than alternative measures, such us net margin or operating margin, because it does not include fixed costs, taxes and amortization, items that are not directly related to inventory management. For lead time or delays (*Lead Time)*, we use the average number of days of accounting payable outstanding. (Rumyantsev and Netessine, 2007). We consider a firm's financial structure, proxied through the debt-to-equity ratio (*Debt Capital)*, because this is a standard determinant of inventory investment (Kashyap *et al.*, 1994; Carpenter *et al.*, 1994; Tribó, 2001). This variable accounts for the opportunity cost of capital for inventory investment. We also include sales growth (*Sales Growth*) measured as the percentage annual growth of sales as a proxy of growth opportunities. Finally, following Cachon and Terwiesch (2005), demand uncertainly is calculated by estimating sales in terms of the lagged value of sales and taking the standard deviation of residuals. This model specification yields the smallest mean squared error.

3.2. Preliminary Evidence

Summary statistics for all variables and Spearman correlations among them are reported in Table 1.

[INSERT TABLE 1 ABOUT HERE]

Table 1 shows that the Spearman correlation between customer CSR and inventory-to-sales ratio is positive (6.5%), while between environment CSR and inventory-to-sales ratio it is

[4] More information is available at http://www.kld.com/research/stats/index.html

[5] We have included in the determination of environment CSR those items of community CSR that cover environmental issues. Moreover, such overlapping between community and environment CSR has lead us to neglect a specific analysis of the impact of community CSR on inventories.

[6] We have rescaled all the measures on social responsibility in order to avoid negative values and facilitate their interpretation and graphical representation. Note that social responsibility is defined as the difference between strength and concerns for the different stakeholders.

negative (-6.4%). Concerning the correlations between the overall *CSR* as well as *Employee CSR* and inventory-to-sales ratio, they are not significantly different from zero. We will see in the following multivariate analysis that CSR and employee CSR will have a non-linear (inverted U-shape relationship) with inventory-to-sales ratio.

Table 2 compares the weight of *Customer CSR*, *Environment CSR* and *Employee CSR* within the overall CSR firm value once we consider two scenarios: observations with CSR ratings above the mean and those below the mean of the CSR distribution.

[INSERT TABLE 2 ABOUT HERE]

Table 2 shows that for higher levels of CSR, there is a significant decrease in the weight of the customers group while the weight of the workers group increases. Both results conform to the idea developed in the theoretical section such that for larger values of CSR, customers' interests reduce their importance in favour of other stakeholders. In the following section we connect this result with the existence of an inverted U-shape relationship between CSR and inventory-to-sales ratio given the positive (negative) relationship between customer (environment) CSR and inventory-to-sales ratio.

3.3. Model Specification

We contrast our theoretical contentions relying on regression techniques and taking advantage of the panel data structure of our sample. Our basic specification is as follows:

$$\begin{aligned} \mathrm{Re}lat\_Inv_{it+1} = {} & \beta_0 + \beta_1 \mathrm{CSR}_{it} + \beta_2 \mathrm{CSR}_{it}^2 + \beta_3 \mathrm{Size}_{it} + \beta_4 \mathrm{Gross\ Margin}_{it} + \beta_5 \mathrm{Lead\ Time}_{it} + \\ & \beta_6 \mathrm{Sales\ Growth}_{it} + \beta_7 \mathrm{Debt\ Capital}_{it} + \beta_8 \mathrm{Sigma}_{it} + \sum_{s=1}^{9} \beta_{8+S} Dummy_{Sit} + \sum_{T=1}^{10} \beta_{17+T} Dummy_{Tit} + \eta_i + \varepsilon_{it} \end{aligned} \quad (1)$$

where we use two subscripts to account for time-specific (t) and company-specific (i) effect. We have included sectoral dummies - $Dummy_{Sit}$ - (1-digit SIC code) as well as temporal dummy variables - $Dummy_{Tit}$ - in the specification.

We employ a linear instead of a multiplicative regression (log transformation) since in the specification we include quadratic terms on CSR in order to test Hypothesis 2.

Our estimating equations for testing Hypotheses 1a, 1b and 1c is equivalent to specification (1), but replacing total *CSR* by *Customer CSR*, *Employee CSR* and *Environment CSR*.

We recognize the possibility that the error term (η_i) may be correlated with changes in a firm's social responsible policies (first endogeneity problem). For example, an intrinsic characteristic of the firm, such as the degree of managerial risk aversion, has an effect on the definition of a firm's social responsible policy as well as on the type of investment policy that will affect inventory levels. This means that there is a spurious correlation between inventory investment and CSR due to the firm-specific component of the error term (η_i). We tackle this problem by conducting estimations in differences. A second endogeneity problem is the reverse causality issue, which is connected with the non-firm specific component of the error term ε_{it}. It may be the case that firms improve their inventory management due to the introduction of a new technology. In this case, the successful introduction of such a new technology will require firms to satisfy their stakeholders' interests in order to ensure their commitment in the acquisition of the required skills for the implementation of the new inventory policy. Hence, the relationship would be from inventories to a firm's CSR. In order to prevent both endogeneity problems, we have led the dependent variable by one period and we have conducted system GMM estimation

(Arellano and Bond, 1991), where we have taken as instruments of the potential endogenous variables (CSR) different temporal lags of these variables.[7]

3.4. Results

Table 3 shows the results of estimating specification (1) without the quadratic term and considering not only the average CSR score (column 1) but those corresponding to specific stakeholders, namely, customers (column 2), employees (column 3) and environment (column 4). Such analysis will allow contrasting Hypotheses 1a, 1b and 1c. [8]

[INSERT TABLE 3 ABOUT HERE]

Column 1 of Table 3 shows that there is not a linear relationship between a firm's CSR and its inventory-to-sales ratio. Once we decompose a firm's social responsible behavior in terms of its policy towards different stakeholders, we find the following results (see column 4). First, the coefficient of Customer CSR is positive (0.191 with t=3.837), which indicates that firms aiming at satisfying customers' interests tend to accumulate more inventories. In particular, one standard deviation in customer CSR (0.629) implies an increase in the inventor-to-sales ratio of 37.31% from the mean value of this ratio. Such result conforms to Hypothesis 1a. Second, there is no linear effect of employees' satisfaction on a firm's inventory policy (coefficient 0.033 with t=1.320 is not significant). In the estimation of Table 4, we are going to obtain a non-linear effect. This result conforms to Hypothesis 1b. Lastly, firms that are more sensitive to environmental issues reduce their inventory-to-sales ratio (coefficient -0.048 with t=-1.864). In economic terms, an increase in one standard deviation in *Environment CSR* (0.786) leads to a decrease of 11.82% in the inventory-to-sales ratio from the mean value of its distribution. This result conforms to Hypothesis 1c.

In terms of the control variables, the results found are the following: first, larger firms use inventories more intensively. This conforms to the wider product variety of larger firms that need to accumulate more inventories for satisfying a diverse demand (Cachon and Terwiesch, 2005).[9] Second, firms with larger gross margins use more inventories. This result is consistent with the fact that larger gross margins mean larger underage (costs of having too little inventories), and hence, firms accumulate more inventories (Silver *et al.*, 1998; Rumyantsev and Netessine, 2007). Lastly, firms with larger debt-to-equity ratios accumulate more inventories. Some papers (Tribo, 2001) argue that larger values of debt, particularly bank debt, may incentivise inventory accumulation given that these assets may be used as collateral in debt contracts.

Table 4 contrasts Hypothesis 2 on the non-linear effects of social responsible behavior on a firm's inventory investment. Column 1 contrasts the general model of specification (1), column 2 substitutes CSR by customer satisfaction, column 3 focus on employee satisfaction, while column 4 shows the results for the environment.

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[7] *System* GMM not only uses information of the equations in differences in order to tackle the fixed-effect problem, but also incorporates the information of the equation in levels in order to improve efficiency in the estimations. Arellano and Bond (1991) developed a Generalized Method of Moments estimator that treats the model as a system of equations, one for each time period. The equations differ only in their instrument/moment condition sets. The predetermined and endogenous variables in first differences are instrumented with suitable lags of their own levels. Concerning the set of equations in levels that are included in order to increase efficiency, predetermined and endogenous variables in levels are instrumented with suitable lags of their own first differences.

[8] We have conducted some additional analysis (not reported) in which we distinguish between finished-good and non-finished-good inventories. We have found that customers' interests mainly affect (positively) finished-goods inventories, while environmental sensitivity mainly reduces non-finished goods inventories.

[9] Some papers (Eppen, 1979; Rumyantsev and Netessine, 2007) suggest a negative relationship between firm's size and inventories given that larger firms can pool together demand from many locations, which reduces risks. In this case, firms do not need to be hedged with larger inventories. This argument is less important in our sample of socially responsible firms that follow low-risk strategies, which means that inventories play a less important role as a hedging mechanism against demand uncertainty.

[INSERT TABLE 4 ABOUT HERE]

Table 4 shows that there is a non-linear relationship between CSR and the inventory-to-sales ratio. In particular, according to column 1 the linear coefficient is positive 0.123 (t=4.239) and the quadratic coefficient is negative -0.005 (t=-3.945). These results indicate that there is an inverted U-shape relationship between CSR and inventory-sales ratio reaching a maximum when CSR=12.55[10], which corresponds to a slightly larger value than the median of the CSR distribution, which has a value of 12. Such result confirms Hypothesis 2. Once, we decompose this non-linear effect considering different types of stakeholders –customers, employees and environment-, we do find a positive, convex relationship for customers (both coefficients for the linear and the quadratic term are positive), an inverted U-shape relationship for employees (the coefficient of *Employee CSR* is positive while that of the quadratic term is negative)[11], and a negative concave relationship for environment (both coefficients are negative). Hence, we can infer the relevance of decomposing the CSR among the different stakeholders in order to study its impact on a firm's inventory policy. Also, and consistently with what we have found in Table 2, we posit that there are two sources of the non-linear effect of CSR on inventory-sales ratio. First, the inverted U-shape connection of employee satisfaction on a firm's inventory policy; and second the positive impact of customer CSR on inventory-to-sales ratio. Note that according to Table 2, increases in the overall value of CSR are associated to significant increases in employee CSR as well as to significant decreases in customer CSR. Finally, the analysis of control variables is consistent with that of the previous table.

The previous results can be summarized in the simulation displayed in Figure 1.

[INSERT FIGURE 1 ABOUT HERE]

4. DISCUSSION AND CONCLUSIONS

This paper analyzes the impact of a firm's social responsible behaviour on its inventory policy. Our basic claim is that there is an inverted U-shape relationship between both variables. We connect this feature to the differential effect on inventories once we decompose a firm's CSR in a set of variables that capture the degree of satisfaction of different stakeholders interests, mainly those of customers, employees and the environment. In particular, we posit that firms aiming to satisfy customers' interests will try to avoid stockouts and will accumulate inventories. Concerning employees, the effect is non-linear and is the outcome of two countervailing effects. On the one hand, a proactive strategy towards employees leads to accumulate inventories, since employee CSR implies long-term labor contracting and, hence, employee turnover is low. Thus, inventory management emerges as an alternative demand-shock smoothing mechanism when firms cannot use employee turnover. On the other hand, employee social responsibility reduces inventories given that firms that satisfy workers' interests are more capable of implementing just-in-time processes, which allow inventory reduction. The final result is an inverted U-shape relationship between employee CSR and inventory level. Finally, concerning the environment, those firms that possess environmental awareness are more likely to accumulate less inventories.

We confirm the previous results making use of a database of 1,881 U.S. manufacturing firms (9,269 observations) for the period 1996-2006. In particular, we find a positive impact of customer satisfaction on inventory-to-sales ratio; a negative impact of a firm's environmental

[10] This is the result of –coefficient (CSR)/ (2 × coefficient (CSR^2))=- 0.123/(2×0.005)=12.55

[11] The maximum is reached for a value of worker CSR = 5.473 that corresponds to broadly the median value of the employee CR distribution, which is 5.

awareness on this ratio and, finally, an inverted U-shape relationship between employees' satisfaction and inventory-to-sales ratio. We have also shown that increases in social responsibility lead to decreases in *Customer CSR* and increases in *Employee CSR*, which combined with the previous results explains the non-linear effect of a firm's overall CSR on inventory-to-sales ratio. In particular, we have found that increases in socially responsible behaviour lead to an increase (decrease) in the inventory-to-sales ratio when a firm's social responsible rating is broadly above (below) the median of the CSR distribution.

Remarkably, our results describe a natural stabilizing mechanism that may smooth the economic cycle. In the expansive periods, a significant proportion of firms invest more on CSR, which according to our results may generate a reduction in inventory accumulation and with that in production. On the contrary, in recessive periods, we find a reduction in CSR, which stimulates inventory investment for CSR-intensive firms, thus preventing steep reductions in production. We believe the effect that we describe may be relevant, given that that in the U.S., the proportion of firms that invest in CSR have increased substantially in recent years. This means that the relative weight of the socially responsible firms in the overall economy has increased steadily and that the inventory policies followed by these firms may be a relevant variable to consider in explaining fluctuations in the economic cycle. The investigation of this issue in greater depth, given the global recession of 2008, is a challenging avenue for future research.

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Table 1: Descriptive and Correlation Matrix

	Mean	DS	Min	Max	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) Relat_Inv	0.322	2.305	0	165.1587	1									
(2) CSR	11.820	2.442	1	26	-0.003	1								
(3) Customer CSR	3.849	0.629	1	7	0.065	0.360	1							
(4) Employee CSR	4.853	0.908	1	9	0.019	0.518	0.189	1						
(5) Environment CSR	5.850	0.786	1	10	-0.064	0.492	0.146	0.056	1					
(6) Size	16518.170	74581.140	0.490	1884318	0.065	0.206	0.009	0.073	-0.213	1				
(7) Gross Margin	0.161	7.673	0	1	0.501	0.195	0.078	0.087	-0.075	0.187	1			
(8) Lead Time	115.295	1332.780	0.411	1752.62	0.250	-0.002	-0.159	-0.019	-0.137	0.433	0.390	1		
(9) Sales Growth	0.531	37.486	-0.958	3608.900	-0.033	0.099	-0.041	-0.034	0.031	-0.047	0.115	0.073	1	
(10) Debt Capital	50.098	78.398	0	2753.780	-0.300	0.000	-0.163	-0.044	0.096	0.087	-0.306	0.020	-0.203	1
(11) Sigma	4767814	32200000	0.115	942000000	-0.004	0.164	0.048	0.124	-0.137	0.863	0.100	0.356	-0.009	-0.010

Correlations are significant when they are above 5%. All variables are defined in the main text.

Table 2: Contingency Analysis

	Obs CSR< Average	Obs CSR> Average	Test of means (ρ>|t|)
Customer Weight	40.1%	37.5%	16.07 (0.000)
Employee Weight	24.1%	27.1%	-20.28 (0.000)
Environment Weight	35.8%	35.4%	5.53 (0.100)

All variables are defined in the main text. In parentheses, the probability of no significant differences between the values contingent on CSR being above or below the mean value of the distribution.

Table 3. Relative inventory level contingent on different stakeholders. Linear Analysis

VARIABLES	(1) Relat_Inv (t+1)	(3) Relat_Inv (t+1)	(4) Relat_Inv (t+1)	(5) Relat_Inv (t+1)
CSR	-0.004			
	(0.687)			
Customer CSR		0.181***	0.180***	0.191***
		(4.515)	(4.249)	(3.837)
Employee CSR			0.016	0.033
			(0.844)	(1.320)
Environment CSR				-0.048**
				(-1.864)
Size (exp-6)	3.410***	3.910***	3.890***	3.470***
	(10.38)	(11.97)	(11.74)	(6.743)
Gross Margin	0.001*	0.001**	0.001*	0.001**
	(1.728)	(1.833)	(1.783)	(1.848)
Lead Time (exp -7)	-1.850	0.141	-0.324	1.470
	(-0.524)	(0.039)	(-0.092)	(0.223)
Sales Growth (exp -5)	-0.584	-0.886	-1.160	-0.551
	(-0.384)	(-0.583)	(-0.764)	(-0.081)
Debt Capital	0.001	0.002***	0.002***	0.002***
	(1.007)	(4.251)	(4.492)	(4.170)
Sigma (exp-10)	-3.580	-0.600	-1.300	-4.200
	(-1.447)	(-0.198)	(-0.409)	(-1.128)
Intercept	-0.030	-0.914	-1.002***	-0.636***
	(-0.0993)	(-3.113)	(-3.334)	(-2.556)
Observations	9269	9269	9269	9269
Fitness test	615.99 (0.000)	402.62 (0.000)	425.66 (0.000)	605.51 (0.000)
AR(2) test	1.35 (0.177)	1.32 (0.187)	1.31 (0.190)	1.30 (0.194)
Hansen test	76.93 (0.148)	63.41 (0.667)	66.35 (0.534)	53.44 (0.734)

All estimations are conducted using Arellano and Bond (1991) system GMM technique. We take up to three temporal lags of the potential endogenous variable as instruments. All variables are defined in the main text. The dependent variable is led by one period. Wald test as the fitness test. The J statistic (p-values reported in parentheses) is distributed as chi-squared under the null hypothesis of instrument validity. The AR(2) is a test for a second-order serial correlation in the residuals, which is distributed as N(0,1) under the null hypothesis of no serial correlation. *** p<0.01, ** p<0.05, * p<0.1

Table 4. Relative inventory level contingent on different stakeholders. Curvi-linear Analysis

VARIABLES	(1) Relat_Inv (t+1)	(2) Relat_Inv (t+1)	(3) Relat_Inv (t+1)	(4) Relat_Inv (t+1)
CSR	0.123***			
	(4.239)			
CSR^2	-0.005***			
	(-3.945)			
Customer CSR		0.196**		
		(2.132)		
Customer CSR^2		0.123**		
		(2.170)		
Employee CSR			0.626***	
			(3.162)	
Employee CSR^2			-0.057***	
			(-3.063)	
Environment CSR				-0.100**
				(-1.980)
Environment CSR^2				-0.0211**
				(-2.017)
Size (exp-6)	3.190***	2.150***	2.840***	2.260***
	(8.379)	(5.458)	(6.149)	(5.310)
Gross Margin	0.001**	0.001**	0.001**	0.001*
	(1.881)	(1.829)	(1.901)	(2.822)
Lead Time (exp -7)	2.450	3.930	4.240	1.180
	(0.642)	(0.560)	(1.041)	(0.879)
Sales Growth (exp -5)	0.4490	1.370	0.962	-2.170
	(0.272)	(0.0385)	(0.534)	(0.368)
Debt Capital	0.001**	0.001	0.001*	0.000
	(2.055)	(0.715)	(1.675)	(0.711)
Sigma (exp-10)	0.000	-5.300	-3.70	-5.630
	(0.102)	(-1.382)	(-0.975)	(-1.138)
Intercept	-0.970***	-1.616**	-1.984***	-1.641
	(-3.004)	(-2.310)	(-3.392)	(-1.350)
Observations	9269	9269	9269	9269
Fitness test	524.55 (0.000)	173.63 (0.000)	331.49 (0.000)	104.79 (0.000)
AR(2) test	1.29 (0.196)	1.27 (0.203)	1.32 (0.188)	1.34 (0.180)
Hansen test	65.22 (0.434)	36.22 (0.999)	44.24 (0.972)	48.64 (0.892)

All estimations are conducted using Arellano and Bond (1991) system GMM technique. We take up to three temporal lags of the potential endogenous variable as instruments. All variables are defined in the main text. The dependent variable is led by one period. Wald test as the fitness test. The J statistic (p-values reported in parentheses) is distributed as chi-squared under the null hypothesis of instrument validity. The AR(2) is a test for a second-order serial correlation in the residuals, which is distributed as N(0,1) under the null hypothesis of no serial correlation. *** p<0.01, ** p<0.05, * p<0.1

Figure 1: Graph of Inventory-to-sales ratio in terms of CSR and different stakeholders' interests